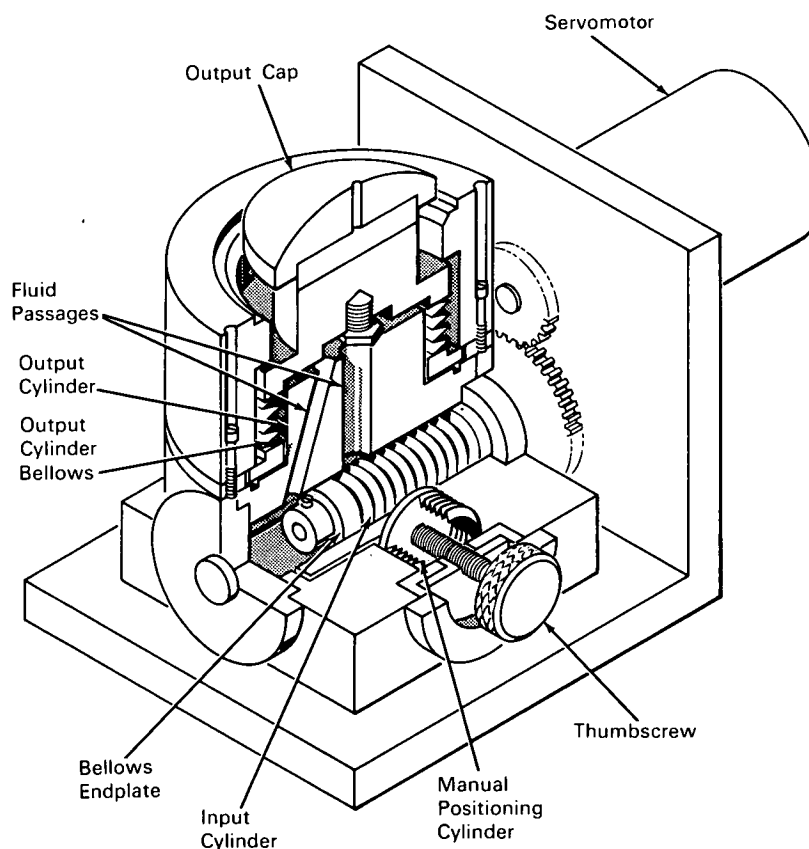


NASA TECH BRIEF



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Hydraulic Device Provides Accurate Displacements to Microinches



The problem: To provide accurate linear displacements on the order of 10^{-6} inches. Certain scientific instruments such as seismographs, interferometers, and autocollimators must be maintained precisely level if their outputs are to be valid. Present day attitude sensing devices are capable of detecting deviations on the order of 10^{-3} inch. A servo device is

needed to translate these measurements into precise corrective displacements.

The solution: A hydraulic drive that uses a differential in input-to-output bellows sizes to translate a relatively large input to the required microinch output. The unit is driven by a servomotor actuated by the output of the attitude sensing device.

(continued overleaf)

How it's done: The hydraulic drive is composed of four interconnecting cylinders, which include a small diameter input cylinder, a large diameter output cylinder, and two small diameter manual positioning cylinders. Bellows are used in each cylinder. Fluid fills the volume of the output cylinder bellows; fluid occupies the space outside the bellows of each of the other three cylinders.

A servomotor drives an axle in the input cylinder whose endplate has a connecting rod threaded through the axle. As the servomotor turns counterclockwise the endplate is moved forward, decreasing the fluid volume in that cylinder, increasing the fluid volume in the output cylinder, and raising the output cap a proportional amount. Output displacement is only a fraction of the input due to the difference in cylinder diameters. Knurled thumbscrews are used to position the bellows endplates of the two manual positioning cylinders. The use of bellows in place of pistons reduces friction drag and thus increases sensitivity in the drive movement.

Notes:

1. This device is capable of raising a load of 18,000 lbs with an accuracy of 1×10^{-6} inch.
2. By placing these drives with proper inputs at two corners of a horizontal triangular platform, a level base can be maintained for precision scientific instruments.
3. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Manned Spacecraft Center
P. O. Box 1537
Houston, Texas, 77001
Reference: B65-10230

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